DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1661-A

PRELIMINARY SURFICIAL GEOLOGIC MAP OF THE NORTHERN PART OF THE TYONEK B-5 QUADRANGLE, SOUTH-CENTRAL ALASKA

By
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1983

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1983

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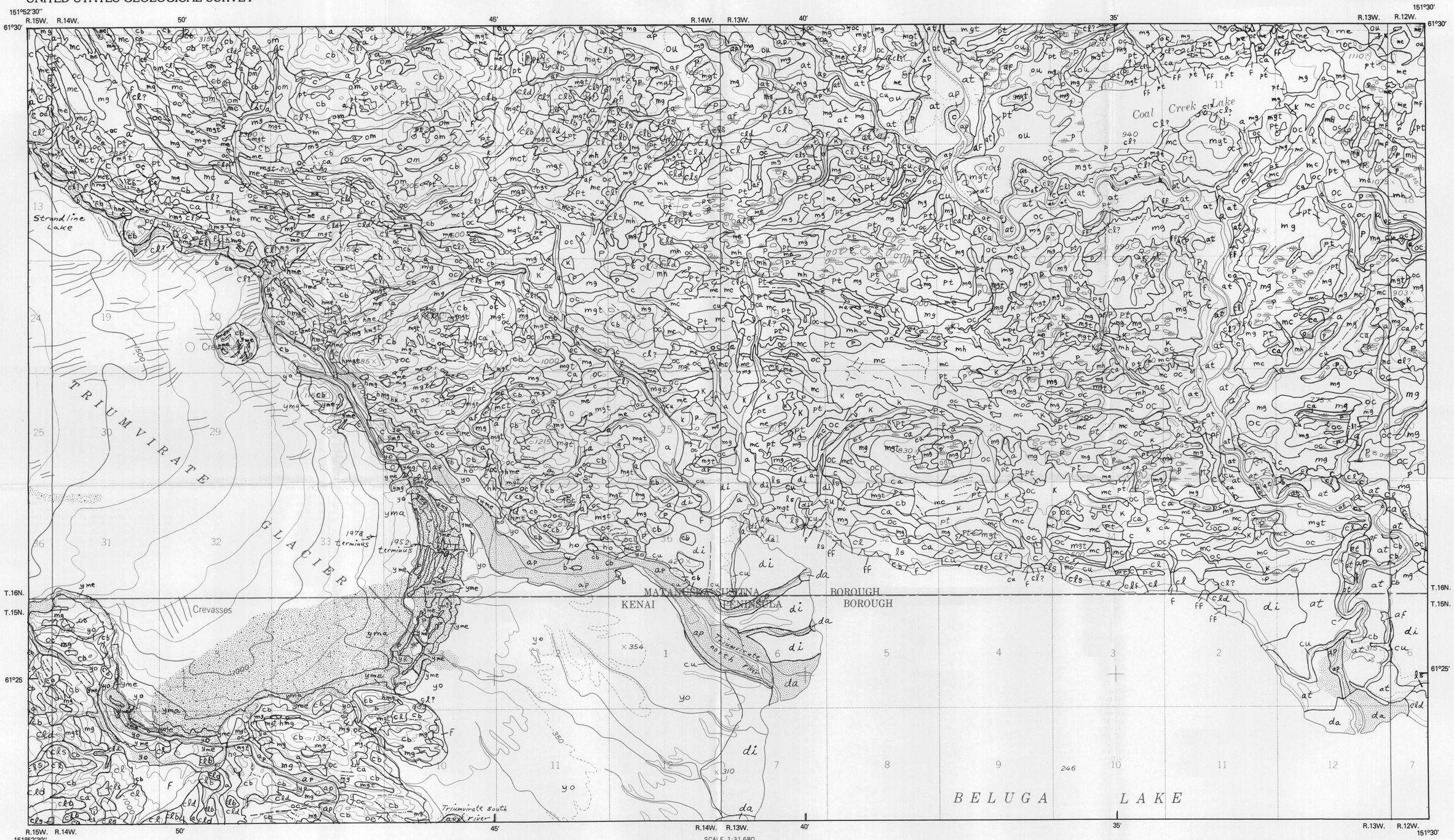


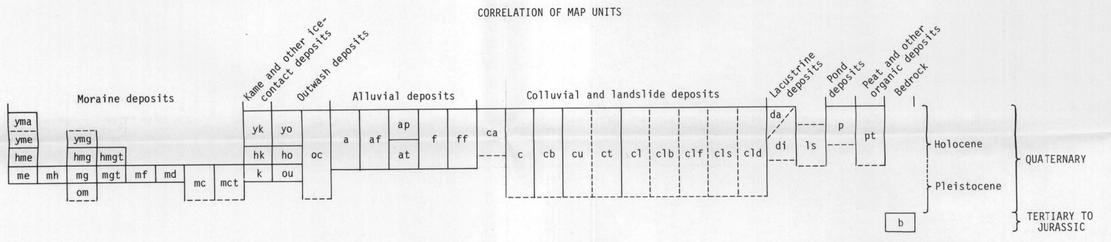
Base from U.S. Geological Survey 1:63,360, 1958
Topography by photogrammetric methods from aerial photographs taken in 1952

SCALE 1:31 680
1 ½ 0 1 MILE
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 100 FEET
DOTTED LINES REPRESENT 50-FOOT CONTOURS

MAP LOCATION

Surficial geology mapped chiefly by L. A. Yehle using year 1952 airphotos. Field checked by L. A. Yehle and H. R. Schmoll, 1977, 1978, and 1980; assisted by J. M. Core, 1978, and C. A. Gardner and A. D. Pasch, 1980.

CORRELATION OF MAP UNITS



INTRODUCTION

The Tyonek B-5 quadrangle lies about midway between Cook Inlet and the Tordrillo Mountains (index map) whose southerly peak is the active volcano, Mount Spurr, 3,375 m high. For presentation of our surficial geologic information we divided the area into three parts; the southeastern and southwestern parts are described respectively on companion maps (Yehle, and others, 1983a, b). In the northern part, divided between Kenai Peninsula and Matanuska-Susitna Boroughs, the principal physiographic element is a moderately steep to gently sloping upland that is transected by the valley of Triumvirate Glacier, its outwash plain, Beluga Lake, and by the narrow valley of Coal Creek. Directly adjacent to Triumvirate Glacier and Coal Creek, slopes are very steep. A variably thick mantle of organic material and interbedded volcanic ash forms an irregular cover over most of the land surface and is generally less than 1 m in thickness. Only on very steep slopes and on flood plains of active streams is the mantle not present. The ash originated from Mount Spurr as well as from other volcanoes in the region (Riehle, 1983). Hydrography of the area is dominated by Beluga Lake and retreating Triumvirate Glacier whose two main outwash channels are unnamed and here informally called Triumvirate north river and Triumvirate south river. Triumvirate Glacier dams a nearby glacier-free tributary valley, the blocked drainage of which forms Strandline Lake, area about 10 km^2; the southeastern corner of the lake occurs at the western edge of the map and of figure 1. Episodic dam failures (most recently in 1982) cause the lake to drain rapidly and major floods to proceed down to and through Beluga Lake, and along the Beluga River to Cook Inlet (index map; Sturm and Benson, 1982). Principal glacial deposits include the young end moraines of late Holocene age adjacent to Triumvirate Glacier and remnants of Denslow Lake lateral moraines of late Pleistocene age (fig. 1); the relationship of these moraines to regional glacial geology is outlined in Schmoll and Yehle (1983). Some large landslides have occurred; these developed mainly in siltstone of the Tertiary Tyonek Formation which probably has a somewhat larger outcrop area, especially near the northwest part of Beluga Lake, than shown on the generalized map of published bedrock data (fig. 2). Other types of bedrock include metamorphic rocks and plutonic intrusive rocks of Jurassic to Tertiary age that underlie uplands in the northwestern part of the area and near the glacier (fig. 2), and possibly underlie part of the gently sloping terrain between West Fork Coal Creek and Beluga Lake.

DESCRIPTION OF MAP UNITS

The map delineates deposits considered to be about 1 m or more in thickness. Grain-size terminology for unconsolidated particles follows the classification of Wentworth (1922). Thicknesses given for deposits generally are estimates. Standard age symbols are omitted from map symbols because all units except bedrock are of Quaternary age.

MORAINE DEPOSITS

Till, primarily diamicton, consisting of gravelly, sandy silt and variable amounts of clay; clasts as large as boulders. Chiefly unsorted, but locally moderately well sorted, as discontinuous lenses of sand to sandy pebble gravel. Moderately compact. Formed into ridges, hummocky ground, and some relatively smooth plains of small size. In places includes scattered bedrock exposures too small to show at 1:31,680 scale

END- AND LATERAL-MORAINE DEPOSITS--Primarily diamicton formed into heterogeneous assemblage of generally moderate relief landforms some of which are steep-sided ridges. Diamicton may contain a high percentage of coarse clasts. Includes some ground-moraine, kame, outwash, pond, alluvial, and peat deposits too small to map at 1:31,680 scale. Thickness probably less than 25 m

yma Actively forming end-moraine and related drift deposits (late Holocene)--Includes ground-moraine, kame, outwash, and pond deposits in the process of formation, with some subsequent modification through mass wastage or destruction by younger outwash streams. Mapped only beyond 1978 terminus of Triumvirate Glacier where ice has melted or partly melted since 1952, as interpreted from August 1978 color infrared airphotos; 1978 position of lateral margin and some of end position of glacier not mapped because not clearly distinguishable from 1952 position. The date of airphotos used to construct the topographic base map is 1952. An estimated maximum rate of retreat of the glacier front is about 23 m/yr

yme End- and lateral-moraine deposits of young advance of Triumvirate Glacier (late Holocene)--Form numerous well-developed, mostly steep-sided ridges, which progress from very sparsely to fully vegetated with increasing distance from the glacier front. In many places diamicton has a relatively sandy matrix. Includes many patches of ground-moraine, kame, and outwash deposits too small to map at 1:31,680 scale. Glacial advance may have terminated within last century, based on fresh appearance of inner moraines and age of about 80 yrs (A.D. 1900) for one of larger spruce trees on nearby outwash distal to outermost moraine

hme Lateral-moraine deposits related to the Chichantna moraine (early? Holocene)--Distributed as scattered remnants mostly parallel to and northeast of Triumvirate Glacier. On the basis of morphologic similarity, these moraines probably correlate with the well-developed Chichantna moraine (Yehle and others, 1983a) in the Chichantna River valley 8 km downvalley from the 1952 terminus of Capps Glacier

me Lateral- and medial-moraine deposits of, and related to, the Denslow Lake moraine (late Pleistocene)--Moraines have gentle sides and are fully vegetated. Within the northwest part of the mapped area, north of Triumvirate Glacier, lateral moraines flank an upland area and seem to be discontinuously traceable as they descend in altitude from about 760 to 520 m, where they lose their identity. A large tract of medial moraine forms a belt about 4 km long southwest of West Fork Coal Creek; northeast of Coal Creek Lake there is a complex of end moraines that becomes progressively better defined east of the map area. These moraines to the east are discontinuopsly traceable to Denslow Lake (index map). Age assignment is tentative and based upon similarity to morphology of the Elmendorf Moraine at Anchorage, Alaska (index map), and age of deposits overlying and underlying the Elmendorf Moraine (Schmoll and others, 1972). The Denslow Lake moraine was previously termed the Carlson Lake moraine (Schmoll and others, 1981)

mh HUMMOCKY MORAINE DEPOSITS RELATED TO THE DENSLOW LAKE MORAINE (LATE PLEISTOCENE)--Diamicton forming landforms having uneven surface topography and very little or no linear continuity. Diamicton may contain a high percentage of coarse clasts. Deposits scattered in the center of the map area and southeast of Coal Creek Lake. Thickness probably as much as 10 m

GROUND-MORAINE DEPOSITS--Form mostly low, rolling mounds on gentle to moderate slopes or on small plains of low relief

ymg Ground-moraine deposits related to young advance of Triumvirate Glacier (late Holocene)--Mostly near toe of Triumvirate Glacier between end-moraine ridges. Thickness probably less than 5 m

hmg Ground-moraine deposits related to the Chichantna moraine (early? Holocene)--Scattered deposits downslope from lateral moraines (hme), northeast of Triumvirate Glacier. Thickness probably less than 5 m

hmgt Thin ground-moraine deposits related to the Chichantna moraine--Probably less than 2 m in thickness. As mapped, includes some outwash-channel, peat, and pond deposits. Thickness probably less than 5 m

Deposits consisting of ground moraine or mostly ground moraine and related to the Denslow Lake moraine

mg Ground-moraine deposits (late Pleistocene)--Scattered throughout most of area especially near Coal Creek. Thickness probably less than 8 m

mgt Thin ground-moraine deposits.--Probably less than 2 m in thickness. As mapped, includes locally common bedrock exposures. Widely distributed north of Triumvirate north river.

mf Moraine deposits in drumlin and fluted landforms (late Pleistocene)--Mostly ground-moraine deposits. Formed parallel to direction of glacier flow; bedrock exposed locally at western end of landform. Located chiefly in northeastern part of area. Thickness probably less than 10 m

md Extensively dissected moraine deposits (late Pleistocene)--In areas where deposits are cut by very numerous narrow, shallow gullies; gullies probably range in depth from 1 to 4 m. Some gullies expose bedrock along their margins; most streams in the gullies are intermittent. Includes some alluvial and colluvial deposits too small to show at 1:31,680 scale. Distributed in a few places north of Beluga Lake in sec. 19, T. 16 N., R. 13 W.

mc Channeled moraine deposits related to the Denslow Lake and older moraines (Pleistocene)--Chiefly ground-moraine deposits in areas containing so many abandoned glacial-meltwater channels that they are too numerous or too small to show individually at 1:31,680 scale. Most channels are approximately parallel to topographic contours and range in depth from 2 to 10 m; bedrock exposed along margins of some channels. Selected channels shown on map. Located principally north of Beluga Lake and scattered elsewhere, including the uplands in northwest part of mapped area. As mapped, includes some outwash-channel, peat, and pond deposits. Thickness probably less than 5 m

mct Thin channeled moraine deposits--Probably average 2 m in thickness. As mapped, includes locally common bedrock exposures. Scattered distribution in sec. 14, T. 16 N., R. 14 W.

om OLD MORAINE DEPOSITS (PLEISTOCENE)--Consists mostly of ground moraine. Compared with other ground-moraine deposits, these deposits are generally thinner, probably averaging 3 m, and locally are covered by the maximum thickness of the mantle of organic material and volcanic ash, probably averaging 1 m. Scattered in *upland* area northeast of Triumvirate Glacier

KAME AND OTHER ICE-CONTACT DEPOSITS

Mostly gravelly sand and some gravelly, silty sand and diamicton in landforms ranging from irregularly shaped kames to narrow and sinuous eskers. Most deposits loose, some relatively compact. Thickness probably less than 15 m

yk DEPOSITS RELATED TO YOUNG ADVANCE OF TRIUMVIRATE GLACIER (LATE HOLOCENE)--Many deposits found in sec. 3, T. 15 N., R. 14 W., others too small to map at 1:31,680 scale are included in the ground-moraine deposits of the young advance of Triumvirate Glacier (ymg)

hk KAME-TERRACE DEPOSITS RELATED TO THE CHICHANTNA MORAINE (EARLY? HOLOCENE)--A few deposits northeast of lower Triumvirate Glacier in sec. 27, T. 16 N., R. 14 W.

k DEPOSITS RELATED TO THE DENSLOW LAKE MORAINE (LATE PLEISTOCENE)--Widely distributed north of Beluga Lake

OUTWASH DEPOSITS

Mostly bedded sandy gravel and sand deposited by glacial meltwaters on wide, low-gradient plains or in small, generally narrow, diamicton- or bedrock-bounded channels most of which are approximately parallel to topographic contours. Most deposits loose and moderately well sorted; commonly more gravelly at depth. Active modern outwash emanating from receding Triumvirate Glacier is mapped chiefly as flood-plain alluvial deposits (ap)

yo OUTWASH-PLAIN DEPOSITS GRADED TO MORAINES OF YOUNG ADVANCE AND TO SOME OF THE ACTIVELY FORMING MORAINE AND RELATED DRIFT DEPOSITS (yma) OF TRIUMVIRATE GLACIER (LATE HOLOCENE)--Near Beluga Lake mapped as delta deposits. Thickness possibly as much as 20 m

ho OUTWASH DEPOSITS RELATED TO THE CHICHANTNA MORAINE (EARLY? HOLOCENE)--Isolated deposits near Triumvirate north river. Thickness probably as much as 10 m

ou OUTWASH DEPOSITS RELATED TO DENSLOW LAKE MORAINE (LATE PLEISTOCENE)--Only larger areas underlain by these deposits are shown on the map. Locally pitted by melt out of remnants of glacier ice between mouth of West Fork Coal Creek and Coal Creek Lake. Scattered west and northeast of Coal Creek. Thickness probably as much as 20 m

oc OUTWASH-CHANNEL DEPOSITS (HOLOCENE AND PLEISTOCENE)--Distributed throughout area. Near Triumvirate Glacier many channels reoccupied by meltwater during each subsequent glacial event. Additional smaller channels contained within the channeled moraine (mc). Commonly overlain by pond or peat and other organic deposits too small to map at 1:31,680 scale. Thickness possibly as much as 5 m

ALLUVIAL DEPOSITS

a ALLUVIAL DEPOSITS, UNDIVIDED (HOLOCENE)--Mostly pebbly sand to cobble gravel deposited by small, medium, and some large streams of low to moderate gradient; includes deposits in low terraces. Bedded and moderately well sorted within beds. Distributed throughout area. Thickness possibly as much as 15 m

af FINE-GRAINED ALLUVIAL DEPOSITS (HOLOCENE)--Chiefly fine sand and some small pebbles, silt, and organic material deposited by small, generally low gradient streams. Commonly uniformly bedded. Several deposits near West Fork Coal Creek. Thickness probably less than 5 m

ap FLOOD-PLAIN ALLUVIAL DEPOSITS (HOLOCENE)--Mostly pebble to cobble gravel and sand deposited on the presently active flood plain and lowest, generally unvegetated terraces of large streams like Triumvirate north and south rivers (both of which are controlled by meltwater from Triumvirate Glacier), and Coal Creek and West Fork Coal Creek (fig. 1). Well bedded and commonly well sorted within beds. Overall sorting along Triumvirate north river poor to good because of great fluctuations of stream capacity whose maximum is dominated by catastrophic floods during breakout of glacier-dammed Strandline Lake (area about 10 km^2). Such floods are known to have occurred at least six times since 1940, the latest on September 17, 1982 (Sturm and Benson, 1982). Thickness possibly as much as 20 m

at ALLUVIAL-TERRACE DEPOSITS (HOLOCENE)--Chiefly sandy gravel and sand forming terraces several meters higher than adjacent active flood plain of Coal Creek and West Fork Coal Creek. Well bedded and commonly well sorted within beds. Thickness probably less than 10 m

f ALLUVIAL-FAN DEPOSITS (HOLOCENE)--Mostly gravel and gravelly sand deposited where active, steep-gradient streams reach more moderate slopes. Commonly irregularly bedded; poorly to moderately well sorted within beds. Scattered throughout area especially near Triumvirate Glacier, West Fork Coal Creek, and the north shore of Beluga Lake. Along the shore, fans are in part poorly defined deltas because of the greatly fluctuating seasonal level of the lake. Thickness possibly as much as 15 m

ff FINE-GRAINED ALLUVIAL-FAN DEPOSITS (HOLOCENE)--Chiefly gravelly sand and sand deposited by steep- to medium-gradient streams. Scattered throughout map area especially near margins of Coal Creek Lake. Thickness possibly as much as 10 m

COLLUVIAL AND LANDSLIDE DEPOSITS

Colluvial deposits consist of irregularly mixed fragments of various sizes and types derived from weathering and chiefly gravity processes acting on older geologic materials. Chiefly diamicton consisting of gravelly or rubbly silt and sand and, locally, some organic material. Generally unsorted. Loose to compact. Landslide deposits consist of numerous types of unconsolidated geologic materials and bedrock in simple to complex landslides that in part grade into one another. Surface varies from very irregular and hummocky to almost smooth. Landslides very extensive in three areas: (1) south of Triumvirate Glacier, (2) west of the mouth of West Fork Coal Creek, and (3) along the shore of Beluga Lake (fig. 1); scattered elsewhere

ca MIXED DEPOSITS OF COLLUVIUM AND MOSTLY FINE-GRAINED ALLUVIUM (HOLOCENE)--In areas where colluvial deposits are crossed by so many small watercourses and their alluvial deposits that the alluvial deposits are too numerous to be mapped separately at 1:31,680 scale. Slopes generally moderate. Widely scattered throughout mapped area. Thickness probably as much as 5 m

c COLLUVIAL DEPOSITS, UNDIVIDED (HOLOCENE AND PLEISTOCENE)--Sources of deposits are both bedrock and unconsolidated materials. Mostly on relatively steep to moderate slopes, notably along present or abandoned stream courses throughout mapped area. Thickness probably less than 5 m

cb COLLUVIAL DEPOSITS DERIVED CHIEFLY FROM BEDROCK (HOLOCENE AND PLEISTOCENE)--On steep to moderately steep bluffs adjacent to present or abandoned stream courses and on relatively steep to moderate slopes especially north and south of Triumvirate Glacier. As mapped, in many places, includes numerous bedrock outcrops. Thickness probably less than 2 m

cu COLLUVIAL DEPOSITS DERIVED CHIEFLY FROM UNCONSOLIDATED MATERIALS (HOLOCENE AND PLEISTOCENE)--Mostly on relatively steep to moderate slopes adjacent to modern streams especially near Coal Creek. Thickness probably less than 5 m

ct TALUS DEPOSITS (HOLOCENE AND PLEISTOCENE)--Rubbly fragments of bedrock commonly of cobble and pebble size occurring below cliffs. Distributed along some steep slopes in northwest part of mapped area. Thickness probably less than 10 m

cl LANDSLIDE DEPOSITS, UNDIVIDED (HOLOCENE AND PLEISTOCENE)--Deposits scattered throughout landslide areas. Thickness possibly as much as 100 m. Queried where identity is somewhat uncertain

clb BLOCK-SLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)--Deposits showing very slight to moderate spreading of original ground surface. The present surface gives appearance of no more than a moderate amount of disruption between blocks; some blocks are as much as several hundreds of meters in longest dimension, especially 6 km west of the mouth of West Fork Coal Creek. Thickness of most blocks probably less than 50 m

clf Fragmented block-slide deposits--Deposits consisting mostly of blocks that were originally much larger but now are broken apart and spread out because of continued movement. Scattered deposits about 4 km west of the mouth of West Fork Coal Creek. Thickness probably less than 10 m

cls SLUMP DEPOSITS (HOLOCENE AND PLEISTOCENE)--Deposits that appear to have rotated at least several degrees from a vertical plane, slid downslope, and then variably spread out. Deposits scattered throughout landslide areas. Thickness probably less than 40 m

cld DEBRIS-FLOW, MUDFLOW, AND DEBRIS-AVALANCHE DEPOSITS (HOLOCENE AND PLEISTOCENE)--Deposits that probably formed by flowage of parent material. Found throughout landslide areas. Deposits probably less than 5 m in thickness

LACUSTRINE DEPOSITS

DELTA DEPOSITS--Mostly pebble gravel and sand deposited into margin of ancestral and modern Beluga Lake: (1) by Triumvirate north and south rivers and outwash stream predecessors, (2) by Coal Creek, and (3) northwest of Beluga Lake, by several small ancestral streams. (Because of small modern streamflow volumes and greatly fluctuating seasonal lake levels, these small streams do not deposit modern deltas defined well enough to map; their distal alluvial deposits are mapped as fans.) Deposits probably finer grained at depth. Thickness possibly as much as 50 m

da Active delta deposits (Holocene)--Deposits formed by presently active distributaries of large streams Triumvirate north and south rivers and Coal Creek

di Mostly inactive delta deposits (Holocene)--Some deposits as much as 60 m above present lake level. Highest deposits probably correlate with remnants of the lateral-moraine deposits related to the Chichantna moraine (hme)

ls EMERGED-SHORE DEPOSITS (HOLOCENE)--Deposits vary from pebbly sand to silt and clay deposited near margin of ancestral Beluga Lake. Found as much as 60 m above present lake level. In places beach berms are well developed and have been shown on the map as lineaments. Thickness probably less than 3 m

p POND DEPOSITS (HOLOCENE)

Chiefly organic-rich silt and organic-rich very fine sand adjacent to modern ponds and lakes. In many places includes organic deposits too small or numerous to show at 1:31,680 scale. Widespread throughout the area. Near the 1952 terminus of Triumvirate Glacier, includes several deposits of silt and sand adjacent to ponds related to melting of the glacier. Adjacent mapped deposits extend beneath the pond deposits. Thickness possibly as much as 4 m

pt PEAT AND OTHER ORGANIC DEPOSITS (HOLOCENE AND LATE PLEISTOCENE)

Organic materials, chiefly mosses, sedges, and some wood fragments, in varying states of decomposition. Includes some silt and very fine sand and numerous, commonly thin layers of volcanic ash, some of which are conspicuous. Soft and moist. As mapped, unit in many places includes pond deposits too small to show at 1:31,680 scale. Adjacent mapped deposits extend beneath the peat deposits. Widespread throughout area. Thickness less than 4 m

b BEDROCK (TERTIARY TO JURASSIC)

In steep bluffs adjacent to northeast margin of Triumvirate Glacier and along Coal Creek. Many scattered bedrock exposures also present within areas underlain by the colluvial deposits, undivided (c) and colluvial deposits derived chiefly from bedrock (cb), especially along the steep-sided hills and uplands south and northeast of Triumvirate Glacier. General types of rocks (fig. 2) indicated by Barnes (1966), Magoon and others (1976), K. A. Dickinson (written commun., 1977), Manning and Hinderman (1979), Beikman (1980), and Merritt and others (1982) include, in areas chiefly near Triumvirate Glacier, mostly metamorphic and plutonic rocks of Jurassic to Tertiary age; sedimentary rocks of the Tyonek Formation of early Oligocene through middle Miocene age (Wolfe and Tanai, 1980) are exposed along Coal Creek and include shale, siltstone, and several coal beds, one of which is 4.6 m thick

——— CONTACT--Approximate, inferred, or indefinite
———..... ABANDONED GLACIAL OUTWASH CHANNEL--Either too small to show separately at 1:31,680 scale or covered by younger deposits. Shown in general location only
—·—·— LINEAMENT--Straight or curvilinear; narrow ridge or narrow topographic depression having possible depositional, groundstability, or tectonic significance

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———1983b, Preliminary surficial geologic map of the Southwestern part of the Tyonek B-5 quadrangle, southcentral Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1661-B, scale 1:31,680.

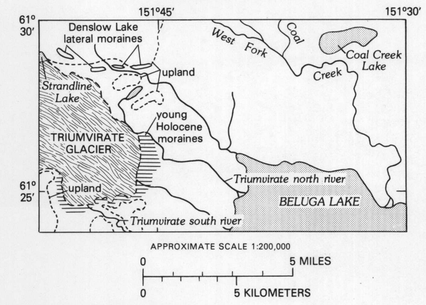


Figure 1.--Selected physiographic and hydrographic features.

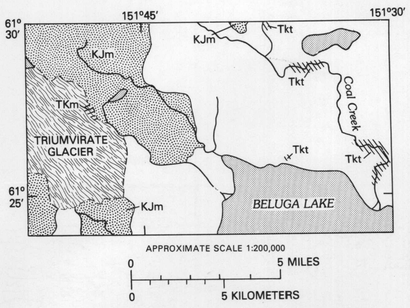
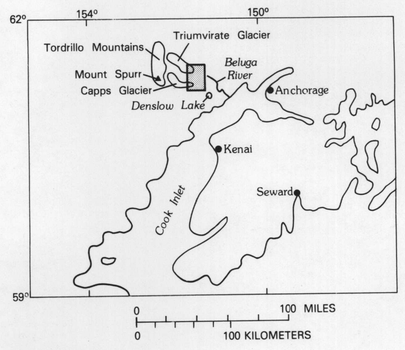


Figure 2.--Generalized bedrock geology from Barnes (1966), Magoon and others (1976), Manning and Hinderman (1979), and Merritt and others (1982). Tkt, Tertiary Kenai Group Tyonek Formation, fine-grained sedimentary rocks; TKm, Tertiary and Cretaceous metamorphic rocks; KJm, Cretaceous and Jurassic metamorphic rocks.



INDEX MAP SHOWING LOCATION OF TYONEK B-5 QUADRANGLE (SHADED)